

What is claimed is:

1. A method for manufacturing a magnetic memory device comprising the steps of:

forming a first wiring;

5 forming a magnetoresistance effect type memory element which comprises a tunnel insulating layer disposed between a ferromagnetic material and which is electrically insulated from the first wiring;

forming an insulating film for covering the memory  
10 element; and

forming a second wiring so that it is buried in the insulating film wherein the second wiring is electrically connected to the memory element and spatially crosses the first wiring through the memory element disposed therebetween,  
15 wherein said method further comprises the steps of:

removing the insulating film on a side portion of the second wiring to expose the second wiring; and

forming a soft magnetic material layer selectively only on a surface of the second wiring.

20 2. The method for manufacturing a magnetic memory device as cited in claim 1, wherein:

said magnetic memory device is a nonvolatile magnetic memory device.

3. The method for manufacturing a magnetic memory device  
25 as cited in claim 1, wherein:

said soft magnetic material layer is formed by an electroless plating process.

4. The method for manufacturing a magnetic memory device as cited in claim 1, wherein:

30 said insulating film on the side portion of the second wiring comprises an etching stopper layer and an interlayer

insulating layer formed on the etching stopper layer; and  
etching is once stopped when removing said interlayer  
insulating layer at step for removing the insulating film on  
the side portion of the second wiring to expose the second  
5 wiring.

5. The method for manufacturing a magnetic memory device  
as cited in claim 1, wherein:

said second wiring is formed in a trench formed on said  
insulating film via a barrier layer; and

10 said barrier layer on the side portion of the second  
wiring is removed after said insulating film is removed and  
before said soft magnetic material layer is formed.

6. The method for manufacturing a magnetic memory device  
as cited in claim 1, wherein:

15 said second wiring is formed in a trench formed on said  
insulating film via a barrier layer; said method for  
manufacturing a magnetic memory device further comprises the  
step of forming a mask pattern between said second wirings  
after said insulating film is removed and before said soft  
20 magnetic material layer is formed; and

said step for forming the soft magnetic material layer  
on the surface of the second wiring comprises the steps of:

forming the soft magnetic material layer selectively  
only on the surface of the second wiring while using said mask  
25 pattern as a mask; and

removing said mask pattern after that.

7. The method for manufacturing a magnetic memory device  
as cited in claim 1, wherein:

said second wiring is formed in a trench formed on said  
30 insulating film via a barrier layer; said method for  
manufacturing a magnetic memory device further comprises,

after said insulating film is removed and before said soft magnetic material layer is formed, the steps of:

removing said barrier layer on the side portion of the second wiring; and

5 forming a mask pattern between said second wirings; and

said step for forming the soft magnetic material layer on the surface of the second wiring comprises the steps of:

forming the soft magnetic material layer selectively only on the surface of the second wiring while using said mask  
10 pattern as a mask; and

removing said mask pattern after that.

8. A method for manufacturing a magnetic memory device, comprising the steps of:

forming a first wiring;

15 forming a magnetoresistance effect type memory element which comprises a tunnel insulating layer disposed between a ferromagnetic material and which is electrically insulated from the first wiring;

forming an insulating film for covering the memory  
20 element; and

forming a second wiring so that it is buried in the insulating film wherein the second wiring is electrically connected to the memory element and spatially crosses the first wiring through the memory element disposed therebetween,  
25 wherein the second wiring is formed through a barrier layer in a trench formed in the insulating film, wherein said method further comprises the steps of:

removing the barrier layer on a sidewall of the second wiring to form a trench so that the sidewall of the second  
30 wiring is exposed; and

forming a soft magnetic material layer selectively only

on a surface including the sidewall of the second wiring while filling the trench.

9. The method for manufacturing a magnetic memory device as cited in claim 8, wherein:

5       said magnetic memory device is a nonvolatile magnetic memory device.

10. The method for manufacturing a magnetic memory device as cited in claim 8, wherein:

      said step for forming the trench comprises the step of  
10   forming said trench on the sidewall of the second wiring by removing said barrier layer on the sidewall of the second wiring as well as by removing said insulating layer of adjacent said barrier layer.

11. A method for manufacturing a magnetic memory device  
15   comprising the steps of:

      forming a first wiring;

      forming a magnetoresistance effect type memory element which comprises a tunnel insulating layer disposed between a ferromagnetic material and which is electrically insulated  
20   from the first wiring;

      forming an insulating film for covering the memory element; and

      forming a second wiring so that it is buried in the insulating film wherein the second wiring is electrically  
25   connected to the memory element and spatially crosses the first wiring through the memory element disposed therebetween, wherein said step for forming said second wiring comprises the steps of:

      forming a barrier layer in a trench for forming said  
30   second wiring formed on the insulating film;

      forming a soft magnetic material layer on a side wall

of the trench via said barrier layer; and

forming said second wiring in said trench via said barrier layer and said soft magnetic material layer; and further comprises a step of selectively forming a soft magnetic material layer after said second wiring is formed.

12. The method for manufacturing a magnetic memory device as cited in claim 11, wherein:

said magnetic memory device is a nonvolatile magnetic memory device.

10 13. The method for manufacturing a magnetic memory device as cited in claim 11, wherein:

said soft magnetic material layer is selectively formed by an electroless plating process.

14. The method for manufacturing a magnetic memory device as cited in claim 11, wherein:

said step for selectively forming the soft magnetic material layer comprises the steps of:

forming a mask pattern on the insulating layer of other than said second wiring;

20 selectively forming the soft magnetic material layer only on the second wiring by electroless plating while using said mask pattern as a mask; and

removing said mask pattern.

15. A magnetic memory device manufactured by a method comprising the steps of:

forming a first wiring;

forming a magnetoresistance effect type memory element which comprises a tunnel insulating layer disposed between a ferromagnetic material and which is electrically insulated from the first wiring;

forming an insulating film for covering the memory

element; and

forming a second wiring so that it is buried in the insulating film wherein the second wiring is electrically connected to the memory element and spatially crosses the first wiring through the memory element disposed therebetween,  
5 wherein said method further comprises the steps of:

removing the insulating film on a side portion of the second wiring to expose the second wiring; and

forming a soft magnetic material layer selectively only  
10 on a surface of the second wiring.

16. The magnetic memory device as cited in claim 15, wherein:

said magnetic memory device is a nonvolatile magnetic memory device.

15 17. The magnetic memory device as cited in claim 15, wherein:

said soft magnetic material layer is formed by an electroless plating process.

18. A magnetic memory device manufactured by a method  
20 comprising the steps of:

forming a first wiring;

forming a magnetoresistance effect type memory element which comprises a tunnel insulating layer disposed between a ferromagnetic material and which is electrically insulated  
25 from the first wiring;

forming an insulating film for covering the memory element; and

forming a second wiring so that it is buried in the insulating film wherein the second wiring is electrically  
30 connected to the memory element and spatially crosses the first wiring through the memory element disposed therebetween,

wherein the second wiring is formed through a barrier layer in a trench formed in the insulating film, wherein said method further comprises the steps of:

removing the barrier layer on a sidewall of the second  
5 wiring to form a trench so that the sidewall of the second wiring is exposed; and  
forming a soft magnetic material layer selectively only on a surface including the sidewall of the second wiring while filling the trench.

10 19. The magnetic memory device manufactured by a method comprising the steps of:

forming a first wiring;

forming a magnetoresistance effect type memory element which comprises a tunnel insulating layer disposed between  
15 a ferromagnetic material and which is electrically insulated from the first wiring;

forming an insulating film for covering the memory element; and

forming a second wiring so that it is buried in the  
20 insulating film wherein the second wiring is electrically connected to the memory element and spatially crosses the first wiring through the memory element disposed therebetween, wherein said step for forming said second wiring comprises the steps of:

25 forming a barrier layer in a trench for forming said second wiring formed on the insulating film;

forming a soft magnetic material layer on a side wall of the trench via said barrier layer; and  
forming said second wiring in said trench via said barrier  
30 layer and said soft magnetic material layer; and further comprises a step of selectively forming a soft magnetic

material layer after said second wiring is formed.

20. The magnetic memory device as cited in claim 19,  
wherein:

5 said soft magnetic material layer is selectively formed  
by an electroless plating process.